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(generic and specific) of all the ferns of the world. It is not to include descriptions, but references are to be given in every instance to descriptions. Synonyms will be given, and the distribution of every species will be indicated. It promises to be a very useful book.—Miss Jane H. Newell, of Cambridge, Mass., has begun the publication, in parts, of a little work to be called "Outlines of Lessons in Botany," designed to be of use to teachers who wish to do more than follow the old methods of botanical teaching. The lessons outlined "are suitable for children of twelve years of age and upwards." Directions are given for raising seedlings, and for making observations upon them in their growth. The parts before us are privately printed, in order to have them tested by other teachers before publication. They may be obtained by any teacher who will use them experimentally, by addressing the author at 175 Brattle street, Cambridge.—DeBary's Lectures upon Bacteria, English translation, has been received from Macmillan & Co. It is a small work, of a sufficiently popular style to enable any well-educated man to get a good idea of the subject. A fuller notice will appear later.—Detmer's Pflanzenphysiologische Praktikum, from Gustav Fischer, of Jena, promises to be a most valuable book in the botanical laboratory. It is an octavo of 352 pages, and is illustrated with 131 wood-cuts.—Dawson's "Geological History of Plants" is an interesting volume of the International Scientific Series, which has just appeared. The style is popular, but the treatment is thoroughly scientific.

ZOOLOGY.

CONJUGATION OF THE INFUSORIA.—The following abstract of M. E. Maupas's observations on the conjugation of the Infusoria (*Comtes Rendus*, 1887, p. 356-9) is taken from the *Journal of the Royal Microscopical Society*. The micronucleus is a hermaphrodite sexual element, of sole importance in conjugation. In the stage (A) it increases in size; it then divides twice (B and C), and eliminates the corpuscles de rebut. This effected, it divides again (D), differentiating a male and female pronucleus. In the next stage (E) the male elements of the two conjugating Protozoa are exchanged, and the new male nucleus fuses with the original female portion. In the next two stages (F and G) the nuclear dualism characteristic of the Ciliata is re-established (the old macronucleus having broken up and been eliminated meanwhile). In the last stage (H) the ex-conjugates reassume their original organization before dividing for the first time.

What is the meaning of all this? There is no special sexual reproduction or generation. There is no acceleration of division after conjugation. It is a period of risk, especially during the

inertia of reconstruction. An *Oxydromus grandis* had from 40,000 to 50,000 descendants while a pair were indulging in a single conjugation. It is a source of destruction, not of the multiplication of individuals.

The riddle was solved by a long series of careful observations. In November, 1885, M. Maupas isolated a *Stylonychia pustulata*, and observed its generations until March, 1886. By that time there had been 215 fissiparous generations. But at that time the colony gave in; the individuals had lost the powers of nutrition and reproduction. Individuals removed at various stages, however, had conjugated with individuals of a different origin. The same experiment was repeated with other forms. In March, 1886, an ex-conjugate from one of the couplings referred to was removed and watched until July 10, when the family again gave in. During that time 315 divisions had been observed. Numerous conjugations had been effected with members removed to other families. This was done till the 130th generation, and till then all the conjugations were fertile. About the 180th generation individuals of the same family which had not hitherto been in contact with one another began in despair to conjugate. The results, however, were *nil*; the conjugates did not even recover from their forlorn hope. Other cases are related.

The result is evident. The process is essential for the *species*. The life runs in developmental cycles of multiplication by division, which are strictly limited. If conjugations with unrelated forms do not then occur the life ebbs. The sexual conjugation of the Ciliates is thus a rejuvenescence, as Bütschle and Engelmann maintained. It is essential as a reorganization of the nucleus. After a prolonged series of divisions the nucleus undergoes senile degeneration. Without conjugation death would be inevitable. The death is a natural one, which some would deny. Sexual conjugation is the necessary condition of their "eternal youth and immortality."

GERMINAL LAYERS OF LOLIGO.—Mr. S. Watase has been studying the development of *Loligo pealei*. He finds that, owing to the immense amount of food yolk present, the gastrulation is masked, and that the mesoderm is formed before the endoderm is fully outlined. He traces the origin of the ink-bag and rectum from the proctodeal invagination, while the stomodeal inpushing gives rise to radula sac, salivary glands, and the digestive glands or "liver." The endoderm is concerned only in forming a yolk membrane, and Mr. Watase thinks it wholly disappears, taking no part in the structure of the adult organs, the alimentary tract being formed solely of stomodeal and proctodeal invaginations.

THE SPONGE SHRIMP, ALPHEUS.—Mr. F. H. Herrick contributes three articles on *Alpheus* to No. 63 of the John Hopkins

University Circulars. He has studied five of the eight known West Indian forms, and finds that they vary considerably in habits and life history. *Alpheus minus* has a complete metamorphosis; in *A. heterochelis* the metamorphosis is abbreviated, while in a species provisionally called *A. præcox* it is almost lost, the young having the big claws developed when it escapes from the egg. In twenty-four hours after hatching the young of the last-mentioned species molt twice, and then have, except size and color, all the characteristics of the adult, even to the pugnacious habits. Although but a tenth of an inch in length, they snap the fingers quite audibly. Mr. Herrick attributes this abbreviation of the development to the parasitic habits, this species, like some others, living in sponges, but burrowing more deeply in them than do the others.

In the embryonic development Mr. Herrick notes that the segmentation proceeds until a syncytium of eight nuclei is formed, and then arise yolk pyramids. After the nuclei reach the surface a germinal area is outlined, and then nuclei migrate from all parts of the surface into the yolk. The gastrulation, which is small, occurs later, and its products likewise pass into the yolk, most of them wandering to the dorsal surface. These wandering cells are believed by endogenous growth to give rise to the "secondary mesoderm cells." Some of these are regarded as forming the regular mesoderm, while others give rise to the blood corpuscles. A remarkable plasticity of the early germinal layers is noticed, it being almost impossible to separate the products of invagination into layers, or to separate others which wander from the ectoderm to which they apply themselves.

PHOSPHORESCENT ORGANS OF FISHES.—On the head and sides of certain deep-sea fishes occur small shining bodies, which Leuckart, Ussow, and Emery have regarded as accessory eyes, but which are now considered as phosphorescent organs. Dr. R. von Lendenfeld has recently studied these organs as exhibited in the collections of the "Challenger" Expedition, and comes to some interesting conclusions. He recognizes no less than twelve types, more than one of which may occur on a single fish. Most of these are small rounded bodies scattered or regularly-arranged upon the upper surface of the body; these are called the "regular ocellar phosphorescent organs," and may be either simple or compound. The simple forms are always isolated, and may be divided into two types according as they are provided with (*Opostomias micripnus*, *Echiostoma barbatum*, *Pachystomias microdon*, *Malacosteus indicus*, *Astronesthes niger*) or lack a pigmented mantle (*Opostomias micripnus*). In no case are they provided with a reflector. The compound organs, which always have a pigmented mantle, consist of a proximal sack-like body and a distal goblet-shaped half, the two portions being separated by a constriction. Some of these (*Oposto-*

mias micripnus, *Echiostoma barbatum*, *Pachystomias microdon*, *Astronesthes niger*) are isolated and stand upright upon the surface, but are still more distinguished by the lack of a reflector. In others (*Argyrops leucogymnus*, *Sternopyx diaphana*, *Scopelus benoiti*) the organ is provided with a shining reflector composed of needle-shaped or filiform elements. All of the foregoing are sunk in the skin, but in *Xenodermichthys nodulosus* occur simple organs which are provided with a pigmented mantle, and which project beyond the general surface and in some cases become stalked. In *Halosaurus macrocheir* and *H. rostratus* the organs are situated upon the scales of the lateral line and have a spindle shape.

The other main group of organs embrace irregular glands which may be scattered (*Astronesthes niger*), or be found on the under jaw (*Argyrops leucogymnus*, *Sternopyx diaphana*); beneath the operculum (*Halosaurus macrocheir*); on the barbels and fin-rays (*Opisthomus micripnus*, *Malacosteus indicus*); or may have a suborbital position, in the latter instance either having (*Echiostoma barbatum*, *Pachystomias microdon*, *Malacosteus indicus*, *Scopelus benoiti*) or lacking a reflector (*Opisthomus micripnus*, *Astronesthes niger*).

The histology of these various types is described. All of the ocellar organs have a large blood and nerve supply, as do the sub-orbital organs of the other division. The others are tubular glands. Usually the ocellar organs are innervated from branches of the spinal nerves, but in *Echiostoma barbatum* the suborbital organs receive their nerve supply from a branch of the trigeminus, which suggests a comparison with the electric nerve of the torpedo.

Both Guppy and Willemoes Suhm have witnessed the phosphorescence in *Scopelus*, and the similarity in structure of all these organs renders it probable that all are phosphorescent. Regarding the glandular organs the evidence is less direct, but judging from the analogy of other forms von Lendenfeld regards them as secreting a phosphorescent mucus. In both we have to deal with various modifications of the mucous canal system. Dr. von Lendenfeld states that the parietal organ of *Sphenodon* (Hatteria) has no homology with these organs, and that it is not, as has been suggested, a phosphorescent organ.

EUTHERIA AND PROTOTHERIA.—In the AMERICAN NATURALIST for December, 1887 (vol. xxi., p. 1103), in a notice of "Thomas on Mammalian Dentition," it is "observed that the unnecessary terms Prototheria and Eutheria, which are generally ascribed to Professor Huxley in England, were really introduced by Professor Gill."

Two quite different propositions were involved by the use of the terms used by Professor Huxley and myself. Professor Huxley

simply substituted my names Prototheria for the Ornithodelphia or Monotremes, and Eutheria for the Monodelphia or Placentalia, introducing a new term—Metatheria—for the Didelphia or Marsupialia. I perfectly concur with the belief that in these senses the terms are unnecessary. But far different was my use of the terms in question, and they were the expressions of a higher generalization. Almost universally the placental mammals had been contrasted with the non-placental. In my “Arrangement of the Families of Mammals” (1872), however, I combined (pp. 45, 46) the Placentals and Marsupials in one category (I.) with the Monotremes, in another (II.) fortifying the contrast by numerous anatomical characters; for these two sections I proposed the names EUTHERIA (I.) and PROTOTHERIA (II.) in the table of “Contents” (pp. v., vi.) of the Arrangement. Subsequently, in “Johnson’s New Universal Cyclopædia” (vol. iii., 1877, p. 262), in the long article “Mammals,” I adopted the terms in connection with the definitions. It was then prevised that “the chief modifications of the class of Mammals are expressed in three types which have been differentiated as sub-classes, viz., Monodelphia, Didelphia, and Ornithodelphia; these are themselves opposable under two categories, EUTHERIA and PROTOTHERIA.” Immediately following, the groups so named were defined at length.

In the sense in which the terms Eutheria and Prototheria were used by myself I consider them to be necessary as the verbal expressions of the generalizations formulated, but as used by Professor Huxley the names are simple synonyms of others long before in general use, and consequently “unnecessary.”—*Theodore Gill*.

THE MULTITUBERCULATA MONOTREMES.—It is announced in *Nature* (Feb. 16, 1888, p. 383) that Mr. E. B. Poulton has discovered teeth in sections of the jaws of a young *Ornithorhynchus anatinus*, made by Professor W. N. Parker. Three have been found in the upper jaw and two in the lower (the ramus imperfect), in the regions covered by the corneous bodies of the adult. The anterior tooth of the maxilla is “long, narrow and simple, as compared with the others.” The other teeth “were broad and large, those of the upper jaw containing two chief cusps in the inner side of the crown, and three or four small cusps on the outer side, while this arrangement was reversed in the lower jaw.”

This observation is of the highest importance. The description reads like that of the dentition of the Plagiaulacid genus *Ptilodus*. *It renders it extremely probable that the Multituberculata are Monotremata*, and not Marsupialia, as has been supposed.—*E. D. Cope*.

ZOOLOGICAL NOTES.—PROTOZOA.—Dr. D. S. Kellicott describes and figures five new species of American Infusoria in the *Microscope* (vii. p. 226). They are *Podophrya inclinata*, *P. flexilis*, *Carchesium granulatum*, and *Opercularia humilis*.

Professor Ernst Haeckel has published an abridgement of his recent monograph of the "Challenger" Radiolaria. It appears under the title "Grundriss einer allgemeine Naturgeschichte der Radiolarian," in a quarto volume of 266 pages, illustrated with 64 of the plates of the "Challenger" Report. The price is sixty marks.

ECHINODERMS.—The brothers Sarasin call attention (*Zool. Anz.*, x. 674) to the powers possessed by *Linckia multifora* of repairing injuries, and figure a specimen where an arm has budded at its extremity a new star fish with four new rays, but state that the madreporic body is not yet developed.

WORMS.—Beddard calls attention (*Zool. Anz.*, No. 268) to the so-called prostrate glands of earth-worms, claiming that these organs in Perichæta are the homologue of the atrium in other earth-worms. He also describes the reproductive organs of Monilogaster, which differ from those of other worms and resemble those of the limicolous forms. He shows that Claparède's division of the Oligochætes is unnatural.

MAMMALS.—August Fjelstrup describes (*Zool. Anz.*, No. 269) the histology of the skin of the black fish, *Globiocephalus melas*, and incidentally states that Eschricht's statement that the number of hairs about the lower jaw and nasal openings and their arrangement may be used in identifying foetal Cetacea is erroneous, these varying with size and development.

ENTOMOLOGY.¹

THE GRASS-EATING THRIPS.—Attention is called by Dr. Lintner in his annual report (reviewed below) to "An Unknown Grass-Pest." As the insect in question is one which I have had under observation for many years, I am able to give more definite information regarding it than is contained in Dr. Lintner's report. In fact, I feel a peculiar personal interest in the insect in question, as it was the first species upon which I made original observations; and in a little work² published thirteen years ago I gave a brief account of it.

This grass-pest is exceedingly common and widespread. It is a species of Thrips, which infests the stalk just above the upper

¹ This department is edited by Professor J. H. Comstock, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

² Notes on Entomology: A Syllabus of a Course of Lectures Delivered at the Cornell University. Ithaca, 1875. (In the second edition of this work the account cited was omitted.)